

Claims

1. Compressed-medium operated nippers for locking rings and the like, comprising a control range (4) with a compressed-medium connection point (56) and a compressed-medium valve connected thereto, at least one driving piston (29) controlled by the compressed-medium valve, and a working range (1) with a feed member (17) adapted to be driven by the driving piston (29) and pivotally supported nipper insert halves (13) the inner lever ends of which are engaged by the feed member (17) to swivel them, characterized in that a force sensor (19) is disposed in the flux of forces between the driving piston (29) and the nipper insert halves (13) for measuring a force dependent on the closing force of the nipper insert halves (13).
2. The compressed-medium operated nippers according to claim 1, characterized in that the force sensor (19) on the feed member (17) measures a force dependent on the closing force of the nipper insert halves (13).
3. The compressed-medium operated nippers according to claim 1 or 2, characterized in that the force sensor (19) is integrated in the feed member (17).
4. The compressed-medium operated nippers according to any one of claims 1 to 3, characterized in that the force sensor (19) is of a plate shape and is disposed transversely to the flux of forces on the feed member (17).

5. The compressed-medium operated nippers according to claim 4, characterized in that the cross-section of the force sensor (19) is approximately congruent with the maximum cross-section of the feed member (17).
6. The compressed-medium operated nippers according to claim 1 to 5, characterized in that the force sensor (19) is held at a central hole of a stud (18) extending in the direction of the flux of forces and which is anchored in the feed member.
7. The compressed-medium operated nippers according to any one of claims 1 to 6 , characterized in that the force sensor (19) is disposed between a portion (17") interacting with the driving piston (29) and a portion (17') of the feed member (17) interacting with the lever ends of the nipper insert halves (13).
8. The compressed-medium operated nippers according to claims 6 and 7, characterized in that the stud (18) is anchored, at its two ends, in the two portions (17', 17") of the feed member (17) and holds the force sensor (19) between the two portions (17', 17") of the feed member (17).
9. The compressed-medium operated nippers according to any one of claims 6 to 8, characterized in that the force sensor (19) is of a ring washer shape.
10. The compressed-medium operated nippers according to any one of claims 6 to 9, characterized in that perforated disks (20) are seated on the stud (18) at either side of the force sensor (19) and that the flux of forces through the force sensor (19) is effected via the perforated disks (20).

11. The compressed-medium operated nippers according to claim 10, characterized in that the perforated disks are ring washers (20).
12. The compressed-medium operated nippers according to any one of claims 1 to 11, characterized in that the force sensor (19) is mounted on the feed member (17) under a bias.
13. The compressed-medium operated nippers according to claim 12, characterized in that the force sensor (19) is biased in the feed member (17) by bolting the stud (18).
14. The compressed-medium operated nippers according to any one of claims 6 to 13, characterized in that a bolting of the stud (18) in the feed member (17) has an anti-rotation lock.
15. The compressed-medium operated nippers according to any one of claims 1 to 14, characterized in that a flexible connecting cable (21) of the force sensor (19) is led out through a slot (22) extending in the direction of motion of the feed member (17) in a housing portion (5) accommodating it.
16. The compressed-medium operated nippers according to claim 15, characterized in that the slot (22) extends across the whole zone of motion of the force sensor (19) with the feed member (17).
17. The compressed-medium operated nippers according to claim 15 or 16, characterized in that the portion of the connecting cable (21) that is led out is fixed to the housing (8).

18. The compressed-medium operated nippers according to any one of claims 15 to 17, characterized in that the slot (22) is firmly covered externally on the housing by a hood (23) which has a cavity (25) in which the connecting cable (21) is designed to undergo deformation while the feed member (17) is being displaced.
19. The compressed-medium operated nippers according to any one of claims 1 to 18, characterized in that a connecting cable (21) of the force sensor (19), while connected to a compressed-medium hose, is led way from the compressed-medium operated nippers.
20. The compressed-medium operated nippers according to any one of claims 1 to 19, characterized in that the force sensor (19) is a foil strain gauge (FSG) sensor and/or a piezosensor.
21. The compressed-medium operated nippers according to any one of claims 1 to 20, characterized in that they have a pressure sensor (57) to monitor the pressure of the compressed medium and that the pressure sensor (57) is connected to an evaluation device.
22. The compressed-medium operated nippers according to claim 21, characterized in that the pressure sensor (57) is integrated in the compressed-medium valve.
23. The compressed-medium operated nippers according to claim 21, characterized in that the pressure sensor (57) is integrated in the compressed-medium connection point (56).

24. The compressed-medium operated nippers according to claim 21, characterized in that the pressure sensor (57) is integrated in a compressed-medium line joined to the compressed-medium connection point (56).
25. The compressed-medium operated nippers according to any one of claims 1 to 24, characterized in that the force sensor (19) and/or the pressure sensor (57) are/is connected to an evaluation device.
26. The compressed-medium operated nippers according to claim 25, characterized in that the evaluation device controls a display for the closing force and/or the pressure of the compressed medium and/or controls means to turn off the compressed-medium operated nippers upon non-observance of a value preset for the closing force and/or a value preset for the pressure and/or controls means to adjust the pressure until a preset value is reached for the closing force and/or for the pressure and/or feeds the values measured for the closing force and/or the pressure to the documentation device.
27. The compressed-medium operated nippers according to claim 25 or 26, characterized in that the display is an optical and/or acoustic display.
28. The compressed-medium operated nippers according to any one of claims 25 to 27, characterized in that the evaluation device and/or the devices fed thereby are electric devices.
29. The compressed-medium operated nippers according to any one of claims 1 to 28, characterized in that they are designed as a hand-held device.

30. The compressed-medium operated nippers according to any one of claims 1 to 29, characterized in that if the working range (1), the control range (4), and the feed member (17) with the force sensor (19) integrated are identical a series of driving ranges including different numbers of serially staggered driving pistons (29, 38, 39, 40) are provided to achieve different closing forces.
31. A unit-assembly system including compressed-medium operated nippers according to any one of claims 1 to 30, characterized in that it comprises compressed-medium operated nippers which have different numbers of serially staggered driving pistons (29, 38, 39, 40) wherein, however, the feed member (17) with the force sensor (19), a working range (1) including the nipper insert halves (13) and a control range (4) including a release lever (55) and a compressed-medium valve coincide with each other.
32. The unit-assembly system including pairs of compressed-medium operated nippers according to any one of claims 1 to 31, characterized in that it comprises compressed-medium operated nippers with a force sensor and/or a pressure sensor and/or an evaluation device and/or a display and/or turn-off means and/or pressure control means and/or a documentation device.